

system, at any period of the eclipse, can be ascertained from the simplest geometrical considerations. In the case of two spheroids, the computation is not so simple.

Still a relation does exist between the amount of distortion due to the mutual attractions of two adjacent bodies, and the rate of obscuration in any eclipse, and this relation is capable of discernment and computation. The difficulty, however, does not lie in the computation: it lies in our inability to determine observations refined enough to respond to a demand so exacting as that which necessitates observations correct to within two-hundredths of a magnitude.

That this degree of accuracy in photometric measurement has been attained to by more than one observer brings the problem of the determination of the figure of a rotating binary system within a reasonable expectation of solution.

Of the twenty-two Algol variables at present known, five are binary systems the component stars of which revolve in contact. It is, therefore, evident that any investigation having as its purpose the figure of the component members of a close binary system should deal first with these five stars.

Particulars of these stars are as follows:—

Chandler No.	Designation.	R.A. 1900.	Decl. 1900.	Period.	Max.	Min.
		h. m. s.	° ' "	d. h. m. s.	m.	m. m.
2852	V Puppis	7 55 22	-48 58' 4"	1 10 54 27	4' 1	4' 7"-4' 9"
3055	X Carinae	8 29 7	-58 53' 2"	1 1 59 0	7' 9	8' 6"-8' 7"
5099	RR Centauri	14 9 55	-57 23' 3"	0 14 32 7	7' 4	7' 8"-7' 8' 5"
6758	β Lyræ	18 46 23	+33 14' 8"	12 21 46 58	3' 4	3' 9"-4' 5"
8598	U Pegasi	23 52 53	+15 23' 9"	0 8 59 41	9' 3	9' 8"-9' 9"

It may be objected that all along it has been assumed that Algol variables are binary systems. What evidence is there that this is so?

In the only cases where independent confirmation is possible—that is, in cases where the stars are bright enough to be dealt with spectroscopically—this confirmation is forthcoming.

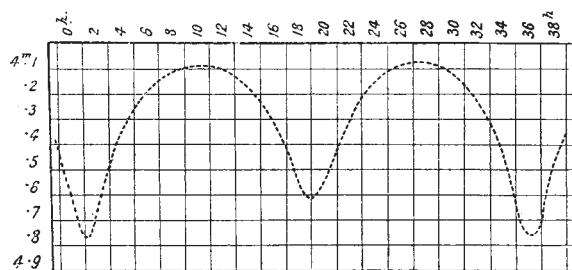


FIG. 1.—Light-curve of V Puppis, from observations made at Lovedale South Africa.

With regard to the foregoing five stars, the spectroscope reveals V Puppis and β Lyræ to be binary systems. The other stars are beyond the reach of spectroscopic examination, at least with its present limitations.

Apart from this, however, revolution and consequent eclipse is the only complete explanation of Algol variation.

In Fig. 1 is given the light-curve of V Puppis, the first star in the list, and this light-curve may be taken as typical of those of the other four stars. Indeed, the light-curve of U Pegasi (*Harvard Circular*, No. 23) is practically identical with that of V Puppis.

The figure of the β Lyræ system has been considered most fully and conclusively by Mr. Myers in the *Astrophysical Journal* (vol. vii. p. 1); one of his definite results being that each star forming the system is not a sphere but an ellipsoid of revolution. The amount of flattening is found to be 0.2 in both stars.

Mr. Myers also deals with the variation of U Pegasi in the same manner (*Astrophysical Journal*, vol. viii. p. 163), and finds that there is distinct evidence, in the form of the light-curve of this star, of an ellipsoidal figure in both components.

In the *Astrophysical Journal* (vol. xiii. p. 177), the writer considered the variation of V Puppis, the first of the five stars. Again it was found that while, to no insufficient extent, the view

that the light-changes were produced by the eclipse of two spheres would meet the facts of variation, an assumption that both components were ellipsoidal in figure would satisfy the observations more fully.

Since the foregoing article was published, an examination of all the observations of X Carinae and RR Centauri made at Lovedale has been completed. It is found that the twin stars of X Carinae have parted company. They are no longer in actual contact, although a distance of only one-tenth of their diameters separates them. The observations of this star also do not indicate an unmistakable distortion of either component.

In the case of RR Centauri we have a twin system similar to that of V Puppis, with this difference, that the form of the light-curve indicates beyond doubt a considerable ellipsoidal form of both stars. Indeed, a dumb-bell figure of equilibrium similar to that indicated in Prof. Darwin's treatise on "Figures of Equilibrium of Rotating Masses of Fluid" (p. 429) would produce variation of the same character as that of RR Centauri.

Of the interest which attaches to all investigations, whether by telescope or spectroscope, concerning these remarkable binary systems, there can be no manner of doubt. For we are dealing with the origin of stellar systems.

Hitherto, in theory only have we had cognisance of some great gaseous orb aggregating itself into two elongated spheroids, dividing after the lapse of long ages into two separate and distinct bodies.

By the action and interaction of their tidal forces, the gap between the component stars grows wider and wider: the system ceases to be a close binary star fulfilling its period in days; it takes months to complete its circuit.

And still the apocentric revolution goes on, until, at last, the star becomes a visual binary, one component separated from its fellow by the width of the whole solar system.

From V Puppis, on the one hand, a dumb-bell system speeding round in thirty-five hours, to the twin stars of Castor, completing their great round in one thousand years, we have a regular chain of sequences in distance.

The links of this chain are made evident by observation as well as by theory. It is not unreasonable, therefore, that the present trend of astrophysical research should be in the direction of discovering more fully and certainly the different stages of evolution and development in the architecture of the heavens.

ALEX. W. ROBERTS.

Lovedale, South Africa, August 9.

A Plea for a Prehistoric Survey of Southern India.

ACCORDING to Mr. R. Bruce Foote, and no one is more competent to speak than he, the urgency for the establishment of a genuine prehistoric survey in Southern India is very great, if the study of this most fascinating branch of archæology is to be encouraged and the wanton destruction of prehistoric monuments checked. Such survey, if honestly carried out, would go far to procure much larger data than yet exist as to the distribution over the southernmost districts of the peninsula of the Palæolithic people whose remains in the shape of chipped stone implements have been found in so many localities in the Carnatic and Deccan plateau, embedded in Pleistocene deposits. Such data might help materially also to bridge over the great hiatus in time which now appears to exist between the era of those very rude people and that of the Neolithic tribes which followed them in the same country.

Further research in the southern districts especially might result in the finding of evidence as to the quarter from which the Dravidian tribes entered the Peninsula—a question of very high ethnological interest.

Another very important ethnological question might possibly be also answered by such investigations, namely, were the first Dravidian immigrants that settled in Southern India in a Neolithic stage of culture, or must the polished-stone people be considered as pre-Dravidian? If the question be answered in the latter way, a fresh immigration must be postulated, by which the true Dravidians reached their present country. If the answer affirms the former proposition, the idea of a further immigration may be dispensed with, for the early iron people appear to be the direct descendants of the Neolithic tribes and the ancestors of the present inhabitants.

Every year numbers of prehistoric burial places are destroyed by the rapacity of the "Waddars," the wandering tribe of tank diggers, who are allowed to annex the fine slabs composing the

kistvaens, while independent archaeologists are, by Government order, forbidden to open any old graves unless they are willing to make over to the Museum all their finds and bear their own expenses. The lapse of time and effects of weather greatly tend to diminish the remains of the old people in the sites they occupied. The action of the plough in many cases, and the trampling of herds of cattle in others, are active elements of destruction of pottery buried near the surface, and even of stone implements. These remarks apply with equal force to the old sites of the early iron age folk, both residential and sepulchral.

Mr. Foote further states in his "Catalogue of the Prehistoric Antiquities" in the Government Museum at Madras, that a full and exhaustive prehistoric survey of the country should be made by a really competent specialist, who shall be a geologist and an osteologist as well as a trained archaeologist, and not a mere architectural surveyor. A knowledge of Sanskrit will be of no use in deciding as to the sources whence were derived the many foreign rocks and minerals found in the many old residential sites, which, up to date, have had only their surfaces examined, but which, doubtless, in many cases will yield rich finds to the careful excavator, who must be a man having the power to devote time to his work.

A. C. HADDON.

Cambridge, September 3.

THE BRITISH ASSOCIATION AT GLASGOW.

IN the previous articles, which appeared in NATURE, May 23, July 18, and August 22, particulars were given as to the local arrangements for the meeting in Glasgow, and a forecast of the papers to be read at the sectional meetings was published. The president, Principal A. W. Rücker, delivered his presidential address, which we print in this issue, as we went to press yesterday, and the business of the sections commenced this morning. A large number of British leading men of science are present at the meeting, and many well-known men of science are also present from abroad. Among others, the following are attending the meeting:—Prof. L. Kny, Berlin; Prof. George Quincke, Heidelberg; Prof. G. Mittag-Leffler, Stockholm; Dr. Gustav Cassil, Copenhagen; Prof. A. F. Renard, Ghent; Prof. Gustave Gilson, Louvain; Mr. A. Laurence Rotch, Readville, Mass., U.S.A.; Prof. R. H. Thurston, Cornell University; Dr. T. P. Lotsy, Arnheim, Holland; Dr. Theodor Beer, Vienna; Prof. J. J. Mackenzie, Toronto; Prof. E. W. Morley, Cleveland, Ohio; Prof. Joji Sakurai, Tokyo; His Excellency Don Arturo de Marcoartu, Bilbao; Prof. J. P. McMurrick, Michigan; Dr. V. Crémieu, Paris; Prof. Dr. W. Marikwald, Berlin; Prof. Paul Walden, Riga; Prof. Goebel, Munich; Dr. C. E. Guillaume, Sevres; Dr. Conventz, Danzig; Baron Varilla, Paris; Mr. Edward Atkinson, Brooklyn; Prof. Anitchkoff, Russia.

The meeting promises to be a successful one, both from the point of view of numbers and that of scientific interest.

INAUGURAL ADDRESS BY PROF. ARTHUR W. RÜCKER, M.A., LL.D., D.Sc., SEC.R.S., PRESIDENT OF THE ASSOCIATION.

THE first thought in the minds of all of us to-night is that since we met last year the great Queen, in whose reign nearly all the meetings of the British Association have been held, has passed to her rest.

To Sovereigns most honours and dignities come as of right; but for some of them is reserved the supreme honour of an old age softened by the love and benedictions of millions; of a path to the grave, not only magnificent, but watered by the tears both of their nearest and dearest, and of those who, at the most, have only seen them from afar.

This honour Queen Victoria won. All the world knows by what great abilities, by what patient labour, by what infinite tact and kindness, the late Queen gained both the respect of the rulers of nations and the affection of her own subjects.

Her reign, glorious in many respects, was remarkable, outside these islands, for the growth of the Empire; within and without them, for the drawing nearer of the Crown and the people in

mutual trust; while, during her lifetime, the developments of science and of scientific industry have altered the habits and the thoughts of the whole civilised world.

The representatives of science have already expressed in more formal ways their sorrow at the death of Queen Victoria, and the loyalty and confident hope for the future with which they welcome the accession of King Edward. But none the less, I feel sure that at this, the first meeting of the British Association held in his reign, I am only expressing the universal opinion of all our members when I say that no group of the King's subjects trusts more implicitly than we do in the ability, skill, and judgment which His Majesty has already shown in the exercise of the powers and duties of his august office; that none sympathise more deeply with the sorrows which two great nations have shared with their Sovereigns; and that none cry with more fervour, "Long live the King!"

But this meeting of the British Association is not only remarkable as being the first in a new reign. It is also the first in a new century. It is held in Glasgow at a time when your International Exhibition has in a special sense attracted the attention of the world to your city, and when the recent celebration of the ninth jubilee of your University has shown how deeply the prosperity of the present is rooted in the past. What wonder, then, if I take the Chair to which you have called me with some misgivings? Born and bred in the South, I am to preside over a meeting held in the largest city of Scotland. As your chosen mouthpiece I am to speak to you of science when we stand at the parting of the centuries, and when the achievements of the past and present, and the promise of the future, demand an interpreter with gifts of knowledge and divination to which I cannot pretend. Lastly, I am President of the British Association as a disciple in the home of the master, as a physicist in a city which a physicist has made for ever famous. Whatever the future may have in store for Glasgow, whether your enterprise is still to add wharf to wharf, factory to factory, and street to street, or whether some unforeseen "tide in the affairs of men" is to sweep energy and success elsewhere, fifty-three years in the history of your city will never be forgotten while civilisation lasts.

More than half a century ago, a mere lad was the first to compel the British Association to listen to the teaching of Joule, and to accept the law of the conservation of energy. Now, alike in the most difficult mathematics and in the conception of the most ingenious apparatus, in the daring of his speculations and in the soundness of his engineering, William Thomson, Lord Kelvin, is regarded as a leader by the science and industry of the whole world.

It is the less necessary to dwell at length upon all that he has done, for Lord Kelvin has not been without honour in his own country. Many of us, who meet here to-night, met last in Glasgow when the University and City had invited representatives of all nations to celebrate the jubilee of his professorship. For those two or three days learning was surrounded with a pomp seldom to be seen outside a palace. The strange middle-age costumes of all the chief Universities of the world were jostling here, the outward signs that those who were themselves distinguished in the study of Nature had gathered to do honour to one of the most distinguished of them all.

Lord Kelvin's achievements were then described in addresses in every tongue, and therefore I will only remind you that we, assembled here to-night, owe him a heavy debt of gratitude; for the fact that the British Association enters on the twentieth century conscious of a work to do and of the vigour to do it is largely due to his constant presence at its meetings and to the support he has so ungrudgingly given. We have learned to know, not only the work of our great leader, but the man himself; and I count myself happy because in his life-long home, under the walls of the University he served so well, and at a meeting of the Association which his genius has so often illuminated, I am allowed, as your President, to assure him in your name of the admiration, respect, nay, of the affection, in which we all hold him.

I have already mentioned a number of circumstances which make our meeting this year noteworthy; to these I must add that for the first time we have a Section for Education, and the importance of this new departure, due largely to the energy of Prof. Armstrong, is emphasised by the fact that the Chair of that Section will be occupied by the Vice-President of the Committee of Council on Education—Sir John Gorst. I will not attempt to forecast the proceedings of the new Section. Educa-